TRANSLOCATION OF ^{125}I, ^{75}Se AND ^{36}Cl TO EDIBLE PARTS OF RADISHES, POTATOES, WHEAT AND BEANS FOLLOWING FOLIAR CONTAMINATION: A FIELD EXPERIMENTAL APPROACH

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In the frame of post-closure safety assessment of geological repositories for nuclear wastes, ^{129}I, ^{79}Se and ^{36}Cl are potential major contributors to the population dose in the long term. According to a scenario of irrigation using a well water, sensitivity analyses performed by the French National radioactive waste management Agency (Andra) have shown a major role of foliar transfer in the possible plant contamination for different radionuclides (RN). Apart for radiocaesium and radiotrontium, foliar transfer studies and translocation factors values are scarce for many RN whatever the vegetal species, and specific data are still lacking in IAEA reference databases for the 3 mentioned key RN.

Experiments were carried out in the Chernobyl Exclusion Zone facilities developed by UIAR, in order to quantify the translocation factor for ^{125}I, ^{75}Se, ^{36}Cl in open field conditions. In those experiments, the translocation factor is defined as the ratio between the activity of the edible part within 1 m^2 of crops at harvest time ($Bq.m^{-2}$) and the foliage activity of crops at the time of deposit ($Bq.m^{-2}$). The experimental approach aimed at simulating a sparkling irrigation with contaminated natural water in usual agricultural conditions. Three main parameters with expected high influence on the translocation process were taken into account: (1) the vegetal specie, (2) the contamination mode (one-shot vs chronicle) and (3) the phenological stage of plant development at the time of contamination. Model plants chosen belong to four great human consumption groups: a root vegetable (*Raphanus sativus L.*), a tuber (*Solanum tuberosum L.)*, a cereal (*Triticum aestivum), and* a fruit vegetable (*Phaseolus vulgaris L.*). Maintaining constant agronomical parameters and avoiding rain washing were main technical issues. A balance of all inputs and outputs was performed, taking into account the intercepted contamination, the contamination of the different plant organs but also eventual soil contamination.

Translocation factors obtained after the first experimental campaign (2009) for ^{125}I, ^{75}Se, ^{36}Cl were respectively in a range of 0.04% to 2.09%, 1.58% to 16.98% and 1.22% to 26.81% independently of the crop or of the contamination mode. In comparison to reference values recommended for other RNs, obtained translocation factor values indicate a medium mobility capacity in vegetal tissues for ^{125}I, a high one for ^{75}Se and a very high one for ^{36}Cl. The phenomenological analysis pointed up a specific behaviour of each element: iodine showed the lowest apparent mobility because of its preferential fixation in or on the leaves, while a significant amount was volatilized; selenium internal transfer was significant and followed a metabolic path, probably the sulphur one, but its bio-methylation can consequently drive to its volatilization; chlorine was very mobile with a quick diffusion to the whole vegetal in relation with its involvement in osmotic and electro-chemical equilibriums.